

## ***Interactive comment on “Earth observation Water Cycle Multi-Mission Observation Strategy (WACMOS)” by Z. Su et al.***

### **Anonymous Referee #5**

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While I understand the importance of reporting on large analysis projects such as this one and the need for systematic generation of observation products, this paper suffers from unclear goals and an poorly defined target audience: is it supposed to be a “project description” paper or is it supposed to be a report of scientific progress? Assuming the former, then all the details about algorithms and processing can be drastically reduced in favor of outlining (more clearly) the goals, planned or on-going activities, and (possibly) some initial accomplishments. Assuming the latter, then much of the programmatic material could be reduced in favor of more complete discussions of the scientific principles behind the analysis approaches. The text makes this project sound like a mere “data factory” – there is no sense of how the products would actually be used to investigate the problems mentioned. In fact, the evident mismatches of

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space-time resolution and coverage of the products are simply ignored as if this would not affect actual research using these products, nor is there any consideration of WHAT ELSE would be needed to carry out the research – as if the four products discussed are sufficient by themselves.

Assuming a programmatic paper, this document is unacceptable because it makes exaggerated and sometimes false claims of what it will do. For a program that claims to be co-sponsored by GEWEX, the text completely ignores all GEWEX activities and data products as if they did not exist. In fact the discussion is completely disconnected from the international research community and its activities – it is written as if no one else is working on related products or research. These disconnects are illustrated by the opening claim that the data products to be produced are “novel”. This claim is simply false: not only have many others produced similar products before, some of those products are GEWEX products that are longer-term that are more complete and much more thoroughly evaluated than what is discussed here. Of course, improvements are possible but then the discussion should focus on what deficiencies there are and HOW the WACMOS effort will fix them. There is none of that here. It is completely unacceptable to ignore the other data products that are already available or to simply say that they are deficient in some way (without citations to relevant literature). It is completely unacceptable to simply assert the superiority of some different algorithm or approach without any discussion of how it differs from previous ones – just because it is different does not make it better.

Assuming a paper that is a summary of scientific results, this document is even more unacceptable because it misrepresents what the data products will be like and relies on algorithms that are as yet untested – the so-called validation plans discussed are far from sufficient as compared with what has already been done for other available products. In fact, the text itself raises some serious issues that are not yet resolved with no indication of how they will be resolved in this project, yet the introduction makes it all seem “wonderful”. As a scholarly work, the text is completely lacking in connec-

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tion to the relevant literature – what is the context of this project, it makes statements about how such products can be produced that are not true, and it generally does not represent the actual state of knowledge about these measurements. These shortcomings are much more egregious for the more mature quantities, water vapor and clouds, that have been analyzed for the past several decades, but the presentations concerning evapotranspiration and soil moisture also do not represent what is known about such products.

The conclusions section begins with the statement that “... understanding the role of the global water cycle ... “ requires measurement “... from space hydro-climatic variables.” So, this project measures four of them but never discusses what will be done with them... they are certainly not sufficient for water cycle studies by themselves. These four products are certainly not “novel” (I can get several examples of each right now) and the analysis approaches described are far from “innovative”, so what is going on and why?

I do NOT recommend publication of this paper.

Some specifics about the “novel” data products: evapotranspiration, soil moisture, clouds and water vapor. None of these products is new and even the analysis approaches are not completely new.

(1) Recent published work has listed more than a dozen global, daily evapotranspiration products produced by a variety of approaches including the one described here. The claim that “current algorithms are too complex for global implementation” is simply false as demonstrated by the existence of many global products. Exactly what satellite measurement provides 1 km and daily resolution with complete global coverage? A daily “repeat time” – that is, daily sampling interval – completely ignores the whole issue of diurnal variations of evapotranspiration, which are not insignificant. In fact, once we see the details, this product is mostly a modeling construct, not an observational product though some observations are used. The model in question has all the nu-

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merous ill-defined, un-measured land surface and vegetation parameters that, in this plan, are not constrained by any observations – there is no explanation of where all the OTHER information will come from. Some of the already-existing products mentioned above use not only more observations than proposed here but more direct approaches to determining the latent heat flux. The authors state explicitly that “no global products of net radiation... exist”... which GEWEX are they co-sponsored by? In the absence of some cloud-penetrating measurement, there is no explanation of how cloudy-day fluxes are determined. Although they say they will evaluate the models use, there is no indication of what data products are needed for this (NOT reanalysis, please) or where they will be obtained from.

(2) Soil moisture has been produced UNSuccessfully from SSM/I for a couple of decades and there are at least two products from AMSR-E that look nothing alike. There is no available evidence that the AMSR-E soil moisture products are the “most reliable” – which one is the most reliable? It is true that AMSR-E has two channels with lower frequencies than SSM/I, but they are still no where near as low a frequency as called for in all the textbooks about soil moisture effects on passive microwave measurements. We have known this since SMMR yet people keep on wishing it weren't true. There is no credible evidence presented that the completely different measurements from the passive and active instruments, with a frequency range of about a factor of 4, can be merged – it is well-known that these sensors do NOT see the same surface properties. Apparently, the data will just be “smashed” together. Actually, this product is going to be tuned to agree with an UN-VALIDATED land surface model... it is not a observation product at all! The final merger of all these disparate measurements, despite spot-cross-checks (which appear to assume all differences are random errors), is to be done by selecting different measurements for different situations – every time this has been tried in the past, it has failed to produce homogeneous products that are useful for climate. Again, there is a lot of attention paid to large spatial variability at small scales and no attention paid to time variability, especially diurnal and weather-related.

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(3) About a dozen cloud products are being compared by GEWEX now, not to mention the ISCCP product which does more than is discussed here. By the way, the group producing the cloud product here is NOT participating in this GEWEX effort, but has been conducting its own separate activity – nothing wrong with that but then should not be claimed to be GEWEX co-sponsored. The proposed retrieval approach does not even account for variations of other surface and atmospheric quantities that are “routinely” accounted for by a number of other cloud products that are already available. Many of the sub-products appear to be monthly mean products – what is the value of that? Again, diurnal variations are completely ignored, which is especially problematic for precipitation. Especially alarming are the cavalier claims about inferring precipitation from the cloud properties. How can day-time-only cloud property measurements be used to characterize the convective rainfall events in the evening, which are known to constitute an important, if not dominant, contribution even over land? If precipitation intensity could really be trivially calculated from current-day determinations of cloud water path (what about ice?) and particle size (known to be biased to cloud top), then there would be no problem with precipitation in GCMs – this is very simple physics – and this approach could be verified against measurements that have been available for the whole MODIS epoch at least. While SEVIRI can obtain the cloud parameters for the “Meteosat view” with high time resolution, what is going to be done with SCIAMACHY, which takes many days to provide ONE sample with complete spatial coverage – this is never explained. Why develop a new surface radiation product when WACMOS is (supposedly) co-sponsored by GEWEX – even so, why not compare to the GEWEX product?

(4) Again, there are many already-available water vapor products, including numerous “analyses” and “reanalyses”, some of which have been around for decades. Although there are some new types of measurements available (like GPS-based methods), the proposed exploration of “novel methodologies” – which are never defined – seems focused on infrared measurements for clear sky conditions only. In other words, the novel part of a possible project is not really discussed. That also means that this water va-

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por product will be spatially and temporally anti-correlated with the cloud-precipitation product, which is very curious – how will water studies be done with these two?

Other problems.

(1) The second sentence of the Introduction starts off with an erroneous statement that means that the whole concept is flawed: incident solar radiation at the surface is not the whole story for evapotranspiration – the net longwave and sensible heat fluxes also play a role, albeit smaller – but this program completely ignores longwave radiation exchanges. Oceanographers used to do this all the time (although surface temperature is less variable, air temperature is not, which is why it was a poor idea even over oceans), but this approach doesn't even begin to work for land surfaces.

(2) In the Introduction, if these data products are to be used for studying the atmosphere-land coupling processes, then they need to resolve variations – aka meteorological – consistently. Yet, there is no consideration of the different scales of the products to be produced.

(3) At the end of the Introduction it is claimed that Earth Observations have already provided a “key contribution to the improvement of water governance” – this claim is not only contradicted by much of the rest of the paper, but is well-known to be false. It may be that these data products can be valuable but they have not been used for this purpose yet.

(4) The words “robust”, “integrating” and “synergetic” [sic] (should be “synergistic”) are used throughout in the most annoying way... what is actually meant by these words is never explained.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 7899, 2010.

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